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Pennsylvania Steel Co.
The Blackwell's Island
Bridge



C. Ryan

BLACKWELL'S ISLAND BRIDGE
NEW YORK CITY

COMPLIMENTS OF
THE PENNSYLVANIA STEEL CO.

The Blackwell's Island Bridge

BUILT BY
THE DEPARTMENT OF BRIDGES
CITY OF NEW YORK

HON. J. W. STEVENSON, *Commissioner*
C. M. INGERSOLL, *Chief Engineer*
J. D. WILKENS } *Engineers in Charge*
J. A. KNIGHTON }

STEEL SUPERSTRUCTURE MANUFACTURED AND ERECTED BY
THE PENNSYLVANIA STEEL COMPANY

E. C. FELTON, *President*

J. V. W. REYNDERS, *Vice President*

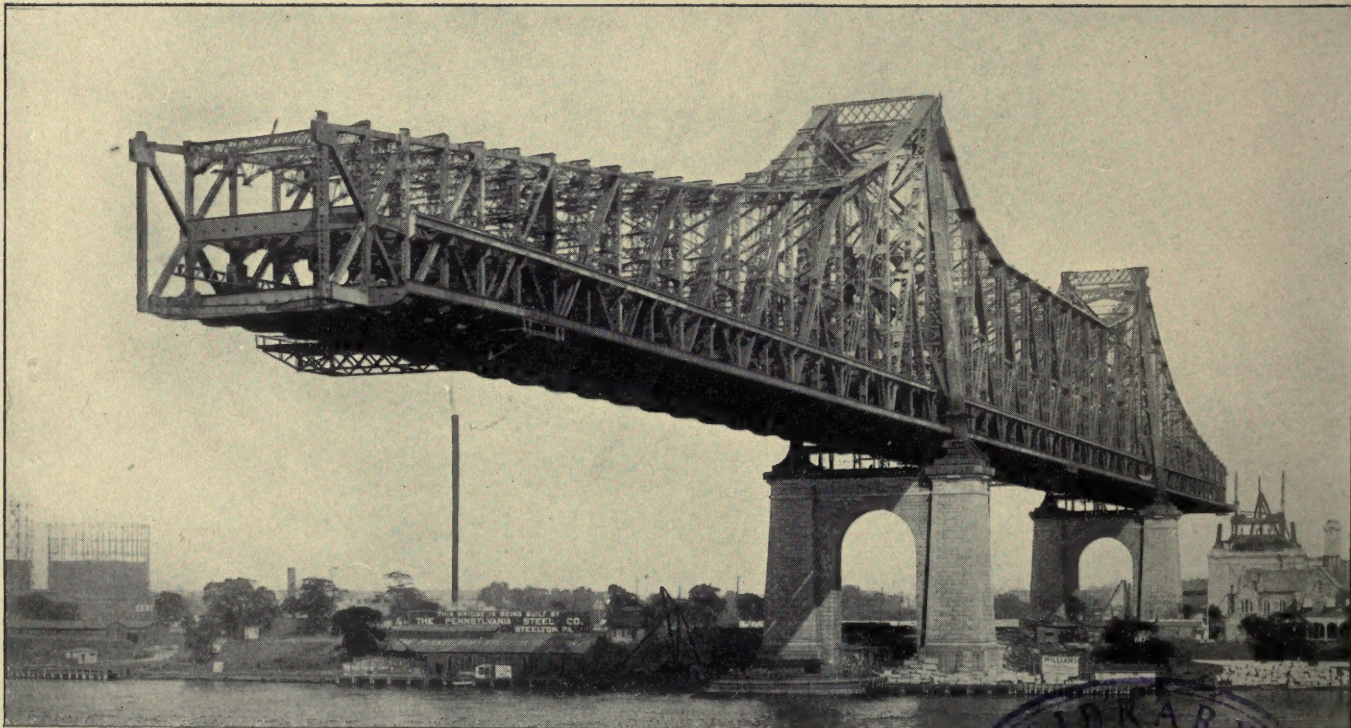
Bridge and Construction Department:

THOMAS EARLE, *Superintendent*

F. C. KUNZ, *Chief Engineer*

F. W. COHEN, *Engineer of Erection*

1908



View showing Island Span and its cantilever arms complete

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BLACKWELL'S ISLAND BRIDGE

Contract for masonry let June, 1901, completed June, 1904. Amount of masonry in piers and foundations, about 54,000 cubic yards.

Contract for superstructure let to the Pennsylvania Steel Company, November, 1903. Will be completed 1908. Weight of steel, about 50,000 tons.

MAIN DIMENSIONS

Length of bridge proper	3,724 ft. 6 in.
*Length of River Span West of Island	1,182 ft.
Length of River Span East of Island	984 ft.
Length of Island Span	630 ft.
Clear Height above mean high water	135 ft.
Width between railings of lower floor	86 ft.
Width between railings of upper floor	67 ft.
Distance center to center of trusses	60 ft.
Maximum grade on bridge	3.41 per cent
Height of towers above bottom chord	185 ft.
Height of trusses of Island Span	118 ft.
Height of trusses at anchor piers	48 ft.
Height of trusses in center of river spans	45 ft.
Longest sub panel of trusses	40 ft.
Shortest sub panel of trusses	20 ft. 6 in.

* There are only three bridges of longer spans in existence: Brooklyn Bridge, 1,595 feet (suspension type); Williamsburg Bridge, 1,600 feet (suspension type); Firth of Forth Bridge, 1,710 feet (Cantilever).

CAPACITY OF BRIDGE

UPPER FLOOR

4 Elevated Railroad Tracks at 1,700 pounds per lineal foot . .	6,800 pounds per foot of bridge
2 Promenades 11 feet wide at 75 pounds per square foot . . .	1,600 pounds per foot of bridge

LOWER FLOOR

2 Outside Trolley Tracks at 1,000 pounds per lineal foot . .	2,000 pounds per foot of bridge
2 Inside Trolley Tracks at 1,000 pounds per lineal foot . . .	2,000 pounds per foot of bridge
1 Roadway 36 feet wide at 100 pounds per square foot . . .	3,600 pounds per foot of bridge

Maximum Live Load 16,000 pounds per foot of bridge

This weight of 16,000 pounds per foot extended over entire bridge is equivalent to the following loading:

250 Rapid Transit Cars carrying	30,000 people
300 Trolley Cars carrying	30,000 people
Congested Traffic on promenade	55,000 people
Congested Traffic on roadway	100,000 people

215,000 people

or about 100 pounds per square foot over entire area of upper and lower floors.

Approximate total dead load including track material, paving, etc., equals 120,000,000 pounds, or 32,200 pounds per foot of bridge.

For the present, only two elevated railroad tracks on the upper floor will be used. When the two other tracks shall be required, the promenades will be placed on outside brackets of the upper floor.

MAXIMUM SECTIONS

Heaviest riveted shoe on top of tower 320 feet above mean high water, dimensions $9 \times 12 \times 15$ feet, weight 140,000 pounds, mostly nickel steel. Each shoe has four separate pins for the top chord and the diagonals.

Heaviest tower post, dimensions $5 \times 11 \times 19\frac{1}{2}$ feet, 1,396 square inches cross section, weight 126,000 pounds, equal to 6,460 pounds per lineal foot.

Heaviest diagonal, dimension 3 feet 6 inches \times 105 feet long, with four ribs, weighs 180,000 pounds.

Heaviest bottom chord, dimensions $4 \times 6 \times 59$ feet, 1,120 square inches cross section, weight 240,000 pounds, equal to 4,100 pounds per lineal foot. Bottom chords are composed of four ribs, with a maximum thickness of metal of $5\frac{3}{4}$ inches.

Heaviest top chord 48 feet long, composed of twenty nickel steel eye bars $16 \times 2\frac{1}{8}$ inches, equal to 680 square inches, cross section.

Height of pedestal under each tower post 10 feet 3 inches, composed of three courses of steel castings, maximum weight of single casting, 41 tons. Weight of one pedestal, 140 tons.

Heaviest nickel steel pin, 16 inches diameter and 10 feet long, weighing about 7,000 pounds. All pins have a hole of 2-inch diameter bored through the axis.

Top laterals between trusses are single rods of $2\frac{5}{8}$ inches diameter, connected to the top chord pins with wing plates and clevises.

Length of floor beams, 55 feet, and maximum weight of one floor beam, 36,000 pounds.

The length of Manhattan Approach being 1,069 feet, of the Queens Approach 2,630 feet, the total length of the bridge, including the approaches, will be about 7,424 feet.

ERECTION

The pieces were excessively heavy. All material was floated to Blackwell's Island and unloaded with special 65-ton derricks, delivered to storage yard served by electric gantries, having 65-ton main hoists and auxiliary hoists of 35 and 10 tons.

Eye bars were packed together and lifted as one member. All heavy members were handled with special lifting devices. Falsework was of steel, specially designed for the erection—first, of the Island Span and later of the East and West Anchor Arms. Rapid jacking devices were provided to take care of any settlement.

Erection of steel was accomplished by two different travelers, to permit of continuity of erection. The first traveler was composed of two derricks and erected the lower floor system and half of the truss of the anchor span. The second traveler was a typical inside "Z" shaped cantilever traveler, weighing approximately 600 tons. This was necessary, as the bridge is hung in a cradle from flared columns, prohibiting an outside traveler, the height of the traveler being limited by the fact that it must go under the portal, which latter must be in place on account of the thrust in it. Therefore a large derrick must be used on top of the traveler to raise the parts of the tower and truss above the traveler.

In lifting the weight is carried directly into the trusses in shear.

Pins are driven with a two-ton ram.

The rivets in the bottom chords are one inch diameter with a seven-inch grip, with only a clear space to drive of twelve inches, calling for special riveting devices,

The Power Plant is located on Blackwell's Island, generating power which is delivered by sub-marine cables to both Manhattan and Queens. The entire plant is equipped with a telephone system, operated from a central exchange.

The total tonnage of structural steel for the falsework and travelers, four thousand tons. The heaviest bottom chord section weighs 120 tons, but is lifted in two pieces. The heaviest diagonal weighs 90 tons and is 100 feet long. Pins approximate 7,000 lbs.

The greatest number of tons erected in one day of eight hours, 512.

The lateral adjustment at center is made by leaving three panels temporarily adjustable. The vertical adjustment is controlled by a screw toggle at the anchorage. No longitudinal adjustment is necessary as this is an expansion point.

The rocking towers weigh 1,500 tons and have to be pulled over with jacking struts approximately seven inches in order to drive the last pin of anchor spans.

The erection of falsework started September 1, 1904. The erection of steel started August 31, 1905.

Work has been interrupted by two strikes, stopping work approximately eight months.

It is estimated that the steel will be all erected during the coming month of March.

BLACKWELL'S

EAST

NEW YORK

THE PENNSYLVANIA

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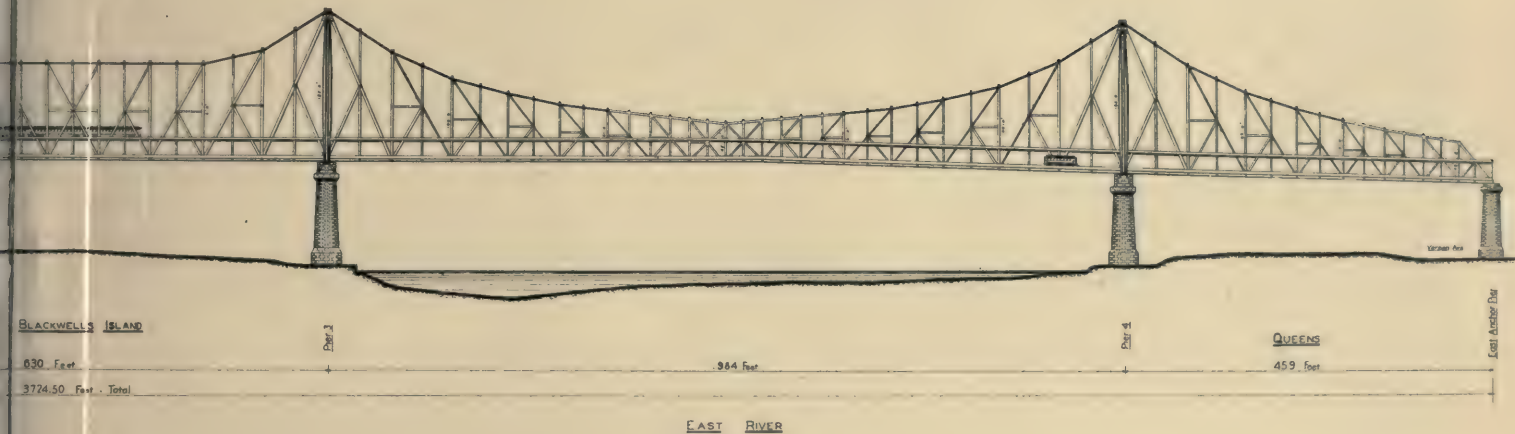


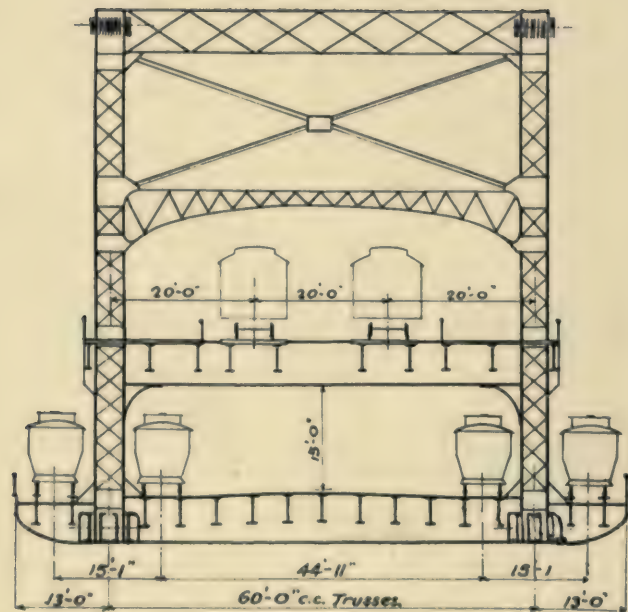
ISLAND BRIDGE

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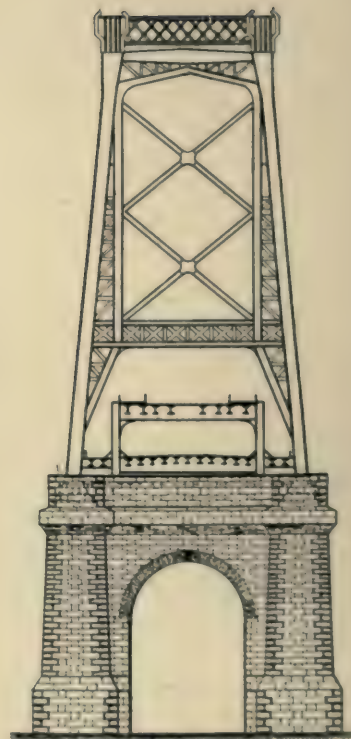
CITY

STEEL CO.





INTERMEDIATE CROSS SECTION.



SECTION AT TOWER
95' 0" c. c. Tower Bases



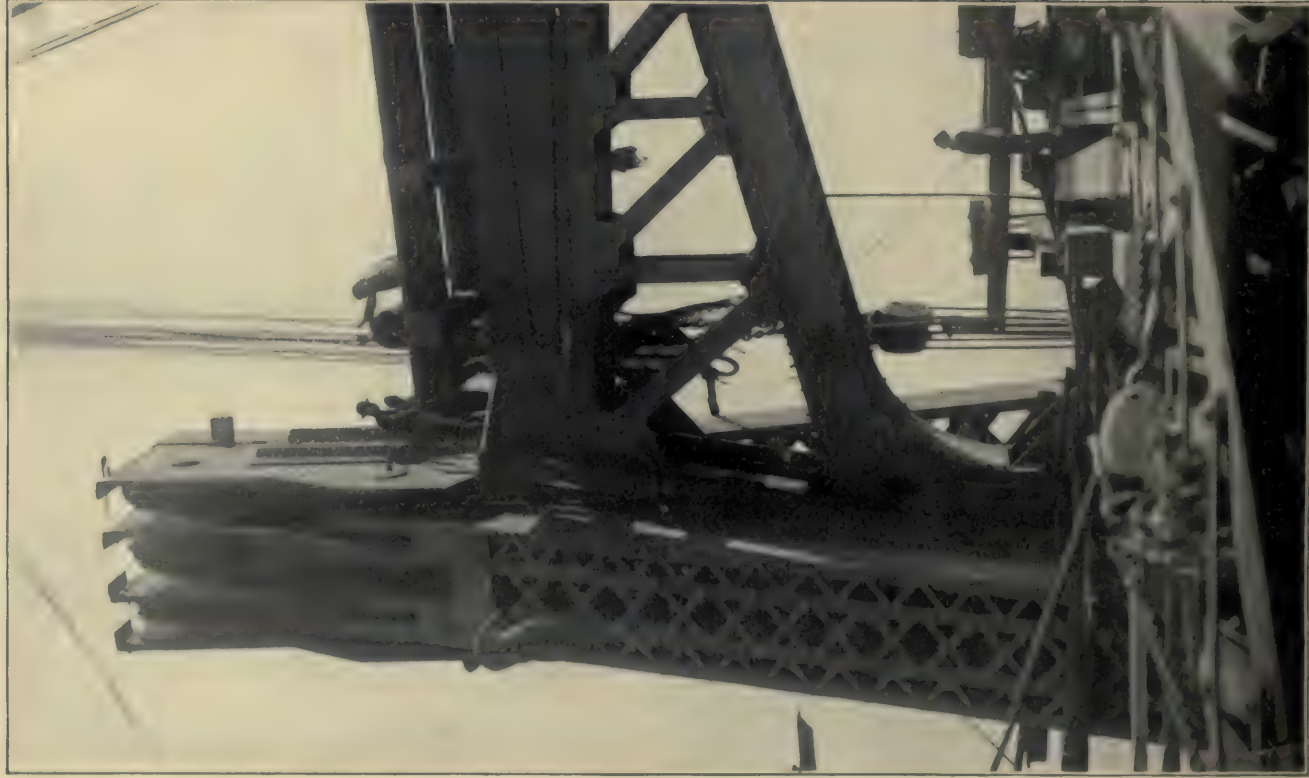
Swinging a main diagonal—weight 156,700 lbs,



Handling material in storage yard on the Island



View of bottom chord L57-L58L on special gun-truck cars



View showing half of tower and connections



View from south showing progress of Island Span



View showing travelers on the Island cantilever arms



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